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Birds of the Arvoredo Marine Biological Reserve, southern Brazil

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Abstract: The Arvoredo Marine Biological Reserve (RBMA) is a protected area in southern Brazil created in 1990 to safeguard the marine biodiversity of the Arvoredo Archipelago. There are only few studies about bird assemblage in most of the Brazilian coastal islands, including this protected area. Therefore, this paper presents the first complete list of birds for RBMA based on data from literature and surveys between 1986 and 2012 on islands and surrounding waters. Birds were recorded during captures using mist-nets and opportunistic observations on land in January 2012, as well as in monthly strip-transects and sectors on sea between 2010 and 2012. The present list includes 84 species (15 captured) from primary data and 22 species from other sources, totaling 106 species from 37 families. Bird assemblage in the RBMA is composed by 44 aquatic birds and 62 landbirds, whereas 13 are endemic to the Atlantic Forest and 12 are threatened. As expected due to the diversity of habitats, Arvoredo and Galé Islands supported the richest assemblages in the RBMA. The number of species in the whole RBMA is smaller than bigger islands elsewhere in the Atlantic Forest domain, but similar to same-sized and same-habitat ones. Our results highlight the importance of this reserve as a suitable and isolated habitat to forest species. Deserta Island is an important site for nesting, resting, and foraging seabirds.

Key words: archipelago, Atlantic Forest, Santa Catarina, Brazil, islands

INTRODUCTION

The Arvoredo Marine Biological Reserve (RBMA) is a protected area in southern Brazil created in 1990 to safeguard the marine biodiversity of the Arvoredo Archipelago. This reserve plays an important role as a resting and breeding site for seabirds (Branco 2003a, 2004; Vooren and Brusque 1999; Efe *et al.* 2000; Branco 2004). Also, it has suitable habitats for terrestrial species since two of the islands are covered by a well-preserved Atlantic Forest (Salvador *et al.* 2009).

In recent decades, the number of studies on seabirds at the RBMA and adjacent coastline has increased substantially (Bege and Pauli 1988; Schiefler and Soares 1994; Soares and Schiefler 1995; Efe *et al.* 2000; Branco 2000; Branco and Ebert 2002; Branco 2003a, 2003b, 2004; Branco *et al.* 2004; Branco and Fracasso 2005; Branco *et al.* 2005; Neves *et al.* 2006; Branco *et al.* 2007; Ebert and Branco 2009; Prellvitz *et al.* 2009; Branco *et al.* 2010a; Cremer and Grose 2010; Hogan *et al.* 2010). Nevertheless, there still are few studies on landbird assemblage in islands at this region (Bege and Pauli 1988; Graipel *et al.* 1997; Ghizoni *et al.* 2013). The available data is insufficient to support management decisions in the RBMA. Therefore, we present a complete list of marine and terrestrial birds of Arvoredo Marine Biological Reserve, discussing aspects of richness, composition, and threatened or endemic species.

MATERIALS AND METHODS

Study area

The RBMA is located in the state of Santa Catarina, southern Brazil, about 10 km from mainland. It comprises 17,600 ha and includes São Pedro Rock, Arvoredo, Galé, and Deserta islands, and the surrounding sea (Figure 1). Arvoredo Island (27°17′ S, 048°21′ W) has 270 ha of Atlantic Forest in different sucessional stages surrounded by cliffs 1–20 m high. Deserta Island (27°16′ S, 048°19′ W) has almost 20 ha of herbaceous and shrubs also bordered by high rocky cliffs. Galé Island (27°10′ S, 048°24′ W) has 160 ha of herbaceous, shrubs, and trees. Galés Island also has two rocky islets northeastern to it. Lastly, São Pedro Rock has 2 ha (27°15′ S, 048°25′ W) with only a few herbaceous cover on the top.

Data Collection

Records were obtained from literature review, birds deposited at *Coleção Científica de Aves da Universidade Federal de Santa Catarina*, *ad libitum* searches, strip-transects with boats, and captures with mist-nets. Literature review considered studies performed within the RBMA geographical limits (27°09′ S, 048°25′ W and 27°17′ S, 048°22′ W, see details in Brazilian Federal Decree 99,142/1990), except for seabirds, which included records made over a wider area (27° S, 048° W and 28° S, 049° W, see Rosário 1996). Sectors with continuous census (following Branco *et al.* 2010b) were performed monthly between May 2010 and March 2012 with a boat cruising at 10 knots around each island. Strip-transects were performed following Camphuysen *et al.* (2004) at the same day as the census by sectors, but

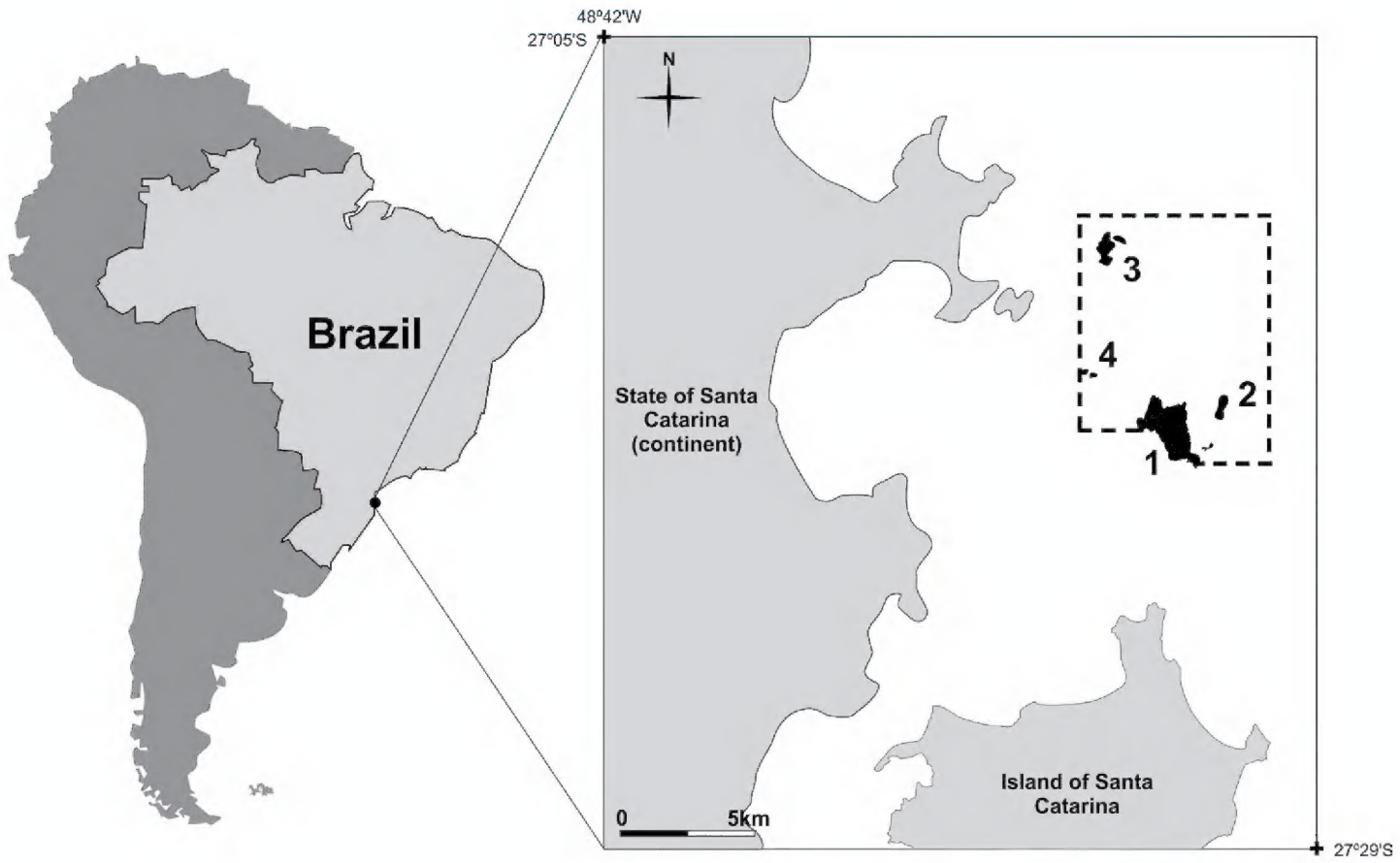

Figure 1. Location of the Arvoredo Marine Biological Reserve (heavy dotted line), southern Brazil. Legend: 1, Arvoredo Island; 2, Deserta Island; 3, Galé Island; 4, São Pedro Rock.

cruising at 20 knots along each of the four routes between islands. Mist-netting (permits CEMAVE SNA no. 3,258-1 and SISBIO no. 22,976-4) occurred from 16–18 January 2012 at *Saco do Capim* (27°17′30″ S, 048°21′56″ W, 70 m elevation), Arvoredo Island, totaling 7,290 h·m^2 effort. *Ad libitum* observations occurred from boats during the intervals of strip-transects or by walking through southern and western sides of the Arvoredo Island (up to 100 m above sea level) during the intervals of mist-netting. Systematic classification and names follow the Brazilian Ornithological Records Committee (CBRO 2014). Species were classified according to habitat and location where they were recorded in the RBMA. Conservation status follows CONSEMA (2011), ICMBio (2014), and IUCN (2014). Atlantic Forest endemic status follows Bencke *et al.* (2006).

RESULTS AND DISCUSSION

Richness and assemblage composition

We listed 106 species from 37 families as occurring in the RBMA (Table 1). From this total, 84 species were recorded during our surveys. Mist-netting resulted in 63 individuals of 15 species banded in the Arvoredo Island (Table 1). Three species were recorded only by this method: *Tangara peruviana* (Desmarest, 1806), *Leptotila rufaxilla* (Richard & Bernard, 1792), and *Leptotila verreauxi* Bonaparte, 1855 (Figure 2). The most captured species were *Turdus albicollis* Vieillot, 1818 and *Thalurania glaucopis* (Gmelin, 1788).

Six *Sterna hirundinacea* Lesson, 1831 and two *Thalasseus acuflavidus* (Cabot, 1847) were found at *Coleção Científica de Aves da Universidade Federal de Santa Catarina* (Table 1). Preview records in the RBMA and surrounding sea were found in: Sick *et al.* (1981), Rosário (1996), Silva (1996), Naka and Rodrigues (2000), Olmos (2000), Roos and Piacentini (2003), Branco (2004), Piacentini *et al.* (2005), Prellvitz *et al.* (2009), and Hogan *et al.* (2010). Records of 22 species came only from literature, including four species only recorded by Alexandre Filippini (*in litt.*) between 1992 and 1993 (Table 1). *Morus serrator* Gray, 1843 was recorded in Bege and Pauli (1988) within the geographical limits established to seabirds in this study, but it was not included due to its vagrancy. The number of species found only in one literature, without subsequent records, may indicate that around 14% of the species are represented by accidentals. Nevertheless, we cannot rule out this may be a bias of the different methods and efforts used by us. Long-term systematic samplings are recommended to confidentially stablish the occurrence status of these species in the RBMA.

Sixty-two species are landbirds occurring in open areas, shrubs or forest (Table 1). Almost half of them were found in at least two different environments. Forty-two species were record in forests and 50% of them were exclusive to this habitat. From the 44 aquatic birds, three were migratory shorebirds and 32 were seabirds. The coastline was also used by terrestrial species (Table 1), such as *Pitangus sulphuratus* (Linnaeus, 1766) and *Athene cunicularia* (Molina, 1782).

Arvoredo and Galé were the most species-rich islands, with 70 and 44 species respectively (Table 1). Both islands have more habitat heterogeneity, from rock cliffs to Atlantic Forest. Data from the Arvoredo Island included 34 species not found in the Galé Island (Table 1). We suppose that real richness of both islands can be higher, since Galé was surveyed only by boat along the shoreline and Arvoredo still needs further efforts in higher forested areas. Deserta Island and São Pedro Rock had 23 and 11 species respectively, probably due to their rocky characteristics, small size, and herbaceous vegetation. Deserta Island has low habitat diversity and its exposure to winds and waves prevents the establishment of terrestrial birds. Nevertheless, Deserta Island plays an important role as a breeding site to Sternidae, Laridae, and Sulidae (Efe *et al.* 2000; Branco 2003a, 2003b; Prellvitz *et al.* 2009; Hogan *et al.* 2010).

Total of species in the whole RBMA is smaller than in larger islands elsewhere in the Atlantic Forest domain,

but similar to same-size and same-habitat ones. Arvoredo Archipelago is richer than other archipelagos throughout the Santa Catarina coastline, such as Itacolomis (17 species; Branco 2004), Tamboretes (15 species; Branco 2004) or Moleques do Sul (31 species; Bege and Pauli 1988). These islands only have herbaceous or shrubs while Arvoredo Archipelago has two islands with developed Atlantic Forest. Relation between richness and forest development is reinforced when comparing Arvoredo Island (67 spp.) to Ratones Grande Island (51 spp.; Graipel *et al.* 1997). On the other hand, the bird richness in RBMA is lower than in larger islands with more habitats, such as Santa Catarina Island (352 spp.; Ghizoni *et al.* 2013), Ilha Grande in the state of Rio de Janeiro (222 spp.; Alves and Vecchi 2009) or São Sebastião Island in the state of São Paulo (207 spp.; Olmos 1996). There is an evident association between richness and size, and richness and habitat complexity and diversity, yet differences in climate, topography, proximity to mainland, and other multi-scale factors could also influence comparisons (Hawkins and Diniz-Filho 2004).

Endemic and threatened species

Among the recorded species, 13 are endemic to the Atlantic Forest (Table 1). Several of these endemic species were also found in other forested islands (see Olmos 1996; Alves and Vecchi 2009), such as *Tachyphonus coronatus* (Vieillot, 1822), *Thalurania glaucopis* (Gmelin, 1788), *Tangara cyanoptera* (Vieillot, 1817), *Chiroxiphia caudata* (Shaw & Nodder, 1793), and *Crypturellus obsoletus* (Temminck, 1815). However, the total of endemics to the Atlantic Forest represents only a quarter of the number of endemics found in other islands such as São Sebastião Island (58 spp.; Olmos 1996) or Grande Island (44 spp.; Alves and Vecchi 2009).

Among the endemics, *Tangara peruviana* is globally and nationally Vulnerable and Endangered at regional level due to habitat loss (CONSEMA 2011; ICMBio 2014; IUCN 2014). The shorebird *Calidris canutus* (Linnaeus, 1758) is Critically Endangered at national level. Ten seabirds listed in this study are also threatened (Table 1). *Diomedea epomophora* and *Procellaria aequinoctialis* are Vulnerable and *Thalassarche chlororhynchos* (Gmelin, 1789) and *Pterodroma incerta* are Endangered at all levels. *Diomedea dabbenena* is Critically Endangered at all levels while *Diomedea exulans* is Critically Endangered at national level but Vulnerable at global and regional levels. *Thalasseus maximus* (Boddaert, 1783) is Endangered at national level and Vulnerable at global and regional levels *Thalassarche chrysostoma* and *Thalassarche melanophris* (Temminck, 1828) are not listed in Brazilian Red List but

Table 1. List of birds recorded at the Arvoredo Marine Biological Reserve, state of Santa Catarina, southern Brazil. Legend: Conservation Status: IU – global-level (IUCN 2014); BR – national-level (ICMBio 2014); SC – state-level (CONSEMA 2011); CR – critical; EN – endangered; VU – vulnerable. Habitat: 1 – pelagic; 2 – coastline; 3 – open area; 4 – shrubs; 5 – forest; * – Atlantic Forest endemic status (Bencke *et al.* 2006). Location: Arv – Arvoredo Island; Gal – Galé Island; Des – Deserta Island; San – São Pedro Rock; Sea – surrounding sea. Record: 1 – record from fieldwork (∞= visual record; V= vocal record; C= captures); 2 – Sick *et al.* (1981); 3 – Rosário (1996); 4 – Silva (1996); 5 – Naka and Rodrigues (2000); 6 – Olmos (2000); 7 – Roos and Piacentini (2003); 8 – Branco (2004); 9 – Piacentini *et al.* (2005); 10 – Prellvitz *et al.* (2009); 11 – Hogan *et al.* (2010); 12 – Alexandre Filippini (*in litt.*); UFSC (code)= specimen deposited at the *Coleção Científica de Aves da Universidade Federal de Santa Catarina*.

Taxa	Conservation Status	Habitat	Location					Record
			Arv	Gal	Des	San	Sea	
Tinamidae								
Crypturellus obsoletus	-	5, *	X	-	-	-	-	1 (V)
Spheniscidae								
Spheniscus magellanicus	-	1	X	X	X	X	X	1 (∞), 3, 8
Diomedeidae								
Phoebetria palpebrata	-	1	-	-	-	-	X	7
Thalassarche chlororhynchos	EN-IU, EN-BR, EN-SC	1	-	-	-	-	X	1 (∞), 3, 8
Thalassarche melanophris	EN-IU, EN-SC	1	-	-	-	-	X	1 (∞), 3, 8, 9
Thalassarche chrysostoma	VU-IU, VU-SC	1	-	-	-	-	X	3
Diomedea epomophora	VU-IU, VU-BR, VU-SC	1	-	-	-	-	X	3
Diomedea exulans	VU-IU, CR-BR, VU-SC	1	-	-	-	-	X	3
Diomedea dabbenena	CR-IU, CR-BR, CR-SC	1	-	-	-	-	X	3
Procellariidae								
Macronectes giganteus	-	1	-	-	-	-	X	3, 9
Fulmarus glacialoides	-	1	-	-	-	-	X	3, 9
Pterodroma incerta	EN-IU, EN-BR, EN-SC	1	-	-	-	-	X	2, 3
Pachyptila belcheri	-	1	-	-	-	-	X	3, 5
Procellaria aequinoctialis	VU-IU, VU-BR, VU-SC	1	-	-	-	-	X	2, 3, 8
Calonectris borealis	-	1	-	-	-	-	X	3
Puffinus griseus	-	1	-	-	-	X	X	1 (∞), 3
Puffinus gravis	-	1	-	-	-	-	X	3
Puffinus puffinus	-	1	-	-	-	-	X	1 (∞), 3
Hydrobatidae								
Oceanites oceanicus	-	1	-	-	-	-	X	1 (∞), 2, 3
Fregatidae								
Fregata magnificens	-	2	X	X	X	X	X	1 (∞), 3, 8, 12

Continued

Table 1. *Continued.*

Taxa	Conservation Status	Habitat	Location					Record
			Arv	Gal	Des	San	Sea	
Sulidae								
Sula leucogaster	-	2	X	X	X	X	X	1 (∞), 3, 8, 12
Sula dactylatra	-	2			X			12
Phalacrocoracidae								
Phalacrocorax brasilianus	-	2	X	X	X	-	X	1 (∞), 8, 12
Ardeidae								
Butorides striata	-	2, 3	X	-	-	-	-	12
Bubulcus ibis	-	3	X	-	-	-	-	1 (∞)
Egretta thula	-	2, 3	X	X	-	-	-	1 (∞), 3, 12
Syrigma sibilatrix	-	3	-	-	X	-	-	12
Cathartidae								
Cathartes aura	-	3	X	X	-	-	-	1 (∞), 12
Coragyps atratus	-	3	X	X	X	-	-	1 (∞), 8, 11
Accipitridae								
Rupornis magnirostris	-	3, 4	X	-	X	-	-	1 (∞), 8, 12
Buteo brachyurus	-	3	X	-	-	-	-	1 (∞), 12
Haematopodidae								
Haematopus palliatus	-	2	X	X	X	X	-	1 (∞) (V), 8, 12
Scolopacidae								
Calidris canutus	CR-BR	2	-	-	-	X	-	1 (∞)
Calidris alba	-	2	-	-	-	X	-	1 (∞), 3
Calidris fuscicollis	-	2	-	-	-	X	-	1 (∞)
Stercorariidae								
Stercorarius chilensis	-	1	-	-	-	-	X	3, 9
Stercorarius maccormicki	-	1	-	-	-	-	X	1 (∞), 9
Stercorarius pomarinus	-	1	-	-	-	-	X	6
Stercorarius parasiticus	-	1	-	-	-	X	X	1 (∞), 6, 8, 9
Laridae								
Larus dominicanus	-	2	X	X	X	X	X	1 (∞) (V), 5, 8, 10, 11, 12
Sternidae								
Sternula superciliaris	-	2	X	X	X	X	X	3
Sterna hirundo	-	2	-	X	X	-	X	1 (∞) (V)
Sterna hirundinacea	VU-BR	2	-	X	X	-	X	1 (∞) (V), 2, 3, 8, 11, 12, UFSC (244, 245, 265-68)
Sterna trudeaui	-	2	-	-	X	-	X	1 (∞), 3
Thalasseus acuflavidus	-	2	X	-	X	-	X	1 (∞) (V), 5, 8, 11, 12, UFSC (269, 278)
Thalasseus maximus	EN-BR, VU-SC	2	-	-	-	-	X	1 (∞), 3, 12
Columbidae								
Columbina talpacoti	-	3, 4, 5	X	X	-	-	-	1 (∞) (V)
Leptotila verreauxi	-	5	X	-	-	-	-	1 (C)
Leptotila rufaxilla	-	5	X	-	-	-	-	1 (C)
Cuculidae								
Guira guira	-	3, 4	-	X	-	-	-	1 (V)
Strigidae								
Athene cunicularia	-	2, 3	X	-	-	-	-	1 (∞), 12
Apodidae								
Streptoprocne zonaris	-	3	-	X	-	-	-	12
Chaetura meridionalis	-	3	-	X	-	-	-	1 (∞)
Trochilidae								
Aphantochroa cirrochloris	-	5, *	X	-	-	-	-	1 (∞)
Florisuga fusca	-	5, *	X	-	-	-	-	1 (∞)
Chlorostilbon lucidus	-	4, 5	X	-	-	-	-	1 (∞) (C), 12
Thalurania glaucopis	-	4, 5, *	X	X	-	-	-	1 (C), 12
Amazilia fimbriata	-	4, 5	X	X	-	-	-	1 (∞) (C)
Alcedinidae								
Megaceryle torquata	-	2	X	X	-	-	-	1 (∞), 12
Chloroceryle amazon	-	2	-	X	-	-	-	1 (∞)
Chloroceryle americana	-	2	-	X	-	-	-	1 (∞)

Continued

Table 1. *Continued.*

Taxa	Conservation Status	Habitat	Location					Record
			Arv	Gal	Des	San	Sea	
Picidae								
Picumnus temminckii	-	5, *	X	-	-	-	-	1 (∞)
Veniliornis spilogaster	-	5, *	X	-	-	-	-	1 (V)
Falconidae								
Caracara plancus	-	3	X	X	X	-	-	1 (∞), 8, 12
Milvago chimachima	-	3	X	X	X	-	-	1 (∞), 8, 12
Milvago chimango	-	3	X	X	X	-	-	1 (∞), 12
Falco peregrinus	-	2, 3	X	-	X	-	-	4, 12
Thamnophilidae								
Thamnophilus caerulescens	-	5	X	X	-	-	-	1 (V) (C), 12
Furnariidae								
Furnarius rufus	-	3, 4	X	-	-	-	-	1 (∞) (V)
Pipridae								
Chiroxiphia caudata	-	5, *	X	-	-	-	-	1 (V)
Tityridae								
Schiffornis virescens	-	5, *	X	-	-	-	-	1 (V)
Platyrinchidae								
Platyrinchus mystaceus	-	5	X	-	-	-	-	1 (∞) (V)
Tyrannidae								
Elaenia flavogaster	-	3, 4, 5	X	X	-	-	-	1 (∞)
Elaenia obscura	-	5	X	-	-	-	-	12
Pitangus sulphuratus	-	2, 3 4, 5	X	X	X	-	-	1 (∞) (V), 3, 12
Myiozetetes similis	-	3, 4	X	X	-	-	-	1 (∞)
Tyrannus melancholicus	-	3, 4, 5	X	X	-	-	-	1 (∞) (V), 12
Myiophobus fasciatus	-	4, 5	X	X	-	-	-	1 (∞) (V) (C)
Lathrotriccus euleri	-	5	X	-	-	-	-	1 (∞)
Empidonomus varius	-	3, 4	X	-	-	-	-	12
Vireonidae								
Cyclarhis gujanensis	-	5	X	X	-	-	-	1 (V), 12
Vireo olivaceus	-	5	X	X	-	-	-	1 (V) (C), 12
Hirundinidae								
Pygochelidon cyanoleuca	-	3	X	X	-	-	-	1 (∞), 12
Progne chalybea	-	3	-	X	-	-	-	1 (∞)
Troglodytidae								
Troglodytes musculus	-	3, 4, 5	X	X	X	-	-	1 (∞) (V) (C), 12
Turdidae								
Turdus flavipes	-	5	X	-	-	-	-	1 (∞), 12
Turdus rufiventris	-	3, 4, 5	X	-	-	-	-	1 (∞)
Turdus amaurochalinus	-	3, 4, 5	X	-	-	-	-	1 (∞) (V), 12
Turdus subalaris	-	5, *	X	-	-	-	-	1 (V)
Turdus albicollis	-	5	X	-	-	-	-	1 (∞) (C), 12
Passarellidae								
Zonotrichia capensis	-	3, 4, 5	X	X	X	-	-	1 (∞) (V), 12
Parulidae								
Parula pitiayumi	-	4, 5	X	-	-	-	-	1 (∞)
Geothlypis aequinoctialis	-	4, 5	X	X	X	-	-	1 (∞) (V), 12
Basileuterus culicivorus	-	4, 5	X	X	-	-	-	1 (∞) (V) (C), 12
Thraupidae								
Coereba flaveola	-	3, 4, 5	X	X	-	-	-	1 (∞) (C), 12
Saltator similis	-	5	X	X	-	-	-	1 (V) (C), 12
Tachyphonus coronatus	-	3, 4, 5, *	X	X	-	-	-	1 (∞) (V) (C), 12
Lanio melanops	-	5	X	-	-	-	-	1 (∞)
Tangara cyanocephala	-	5, *	X	-	-	-	-	1 (∞) (V)
Tangara sayaca	-	4, 5	X	-	-	-	-	1 (∞) (V), 12
Tangara cyanoptera	-	4, 5, *	X	X	-	-	-	1 (∞)
Tangara palmarum	-	4, 5	X	X	-	-	-	1 (∞)
Tangara peruviana	VU-IU, VU-BR, EN-SC	5, *	X	-	-	-	-	1 (C)
Sicalis flaveola	-	3, 4	X	-	-	-	-	1 (∞) (V)
Volatinia jacarina	-	3, 4	X	-	-	-	-	1 (∞)
Sporophila caerulescens	-	3, 4	X	X	-	-	-	1 (∞) (V)
Total of species	**12**		**70**	**44**	**23**	**11**	**32**	**106**

they are respectively Vulnerable and Endangered at global and regional levels. Most of these and other pelagic species have irregular occurrence along most of the Brazilian inshore. All of them seem to use the RBMA to rest and feed while migrating.

Noteworthy records

Some interesting records during surveys are highlighted for the Arvoredo Marine Biological Reserve:

Crypturellus obsoletus: One individual briefly vocalized at *Saco do Capim* on the evening of 16 January 2012. This species is endemic to the Atlantic Forest. Future studies on this species in the RBMA may clarify about the existence of an isolated population, vagrancy or recent colonization patterns.

Puffinus puffinus (Brünnich, 1764): Five individuals swimming between Deserta and Galé Islands on 21 November 2010 and one near the Arvoredo Island on 14 December 2011. This last one was oil-stained on the chest, but with no sign of illness (Figure 3D). The species had been recorded dead in beaches along the Santa Catarina Island (Naka and Rodrigues 2000) and near the mainland (Rosário 1996).

Calidris canutus: A migratory flock with 78 shorebirds resting at the São Pedro Rock was recorded on 30 March 2012 (Figure 3A). Seven individuals had green flags banded in the USA in 2004. They were reported to CEMAVE and the USA Banding and Resightings Project. This species is Critically Endangered in national level (ICMBio 2014).

Stercorarius parasiticus (Linnaeus, 1758): One individual flying near the São Pedro Rock on 30 March 2012 (Figure 3C) and nine swimming, flying or kleptoparasiting *Thalasseus acuflavidus* and *Sula leucogaster* (Boddaert, 1783) on 17 April 2012. Olmos (2000), Branco (2004), and Piacentini *et al.* (2005) presented previous records to the Santa Catarina coastline.

Leptotila rufaxilla and *L. verreauxi*: Five *L. rufaxilla* (rings L121501, N24925, N24927, N24928, and N24929) and one *L. verreauxi* (N24926) were captured at *Saco do Capim* on 17 and 18 January 2012 (Figure 2C, Figure 2D). IBAMA (2004) listed "*Leptotila* sp." without identifying the species. These records confirmed the presence of both *L. rufaxilla* and *L. verreauxi* at the Arvoredo Island.

Chlorostilbon lucidus (Shaw, 1812): Three adult males (A61185, A61185, and A61193) were mist-netted on 17 and 18 January 2012 (Figure 2B). Helmut Sick assumed this bird from the Arvoredo Island could be a new taxon; later analyses showed it was the same from the mainland (Vítor Q. Piacentini, *pers. comm.*).

CONCLUSION

Reviewing published and grey literature as complementary data is an important step to produce checklists (Vieira *et al.* 2014). Findings from literature contributed with many important records of threatened species in the RBMA. Even if these species are rare and went unrecorded during our field

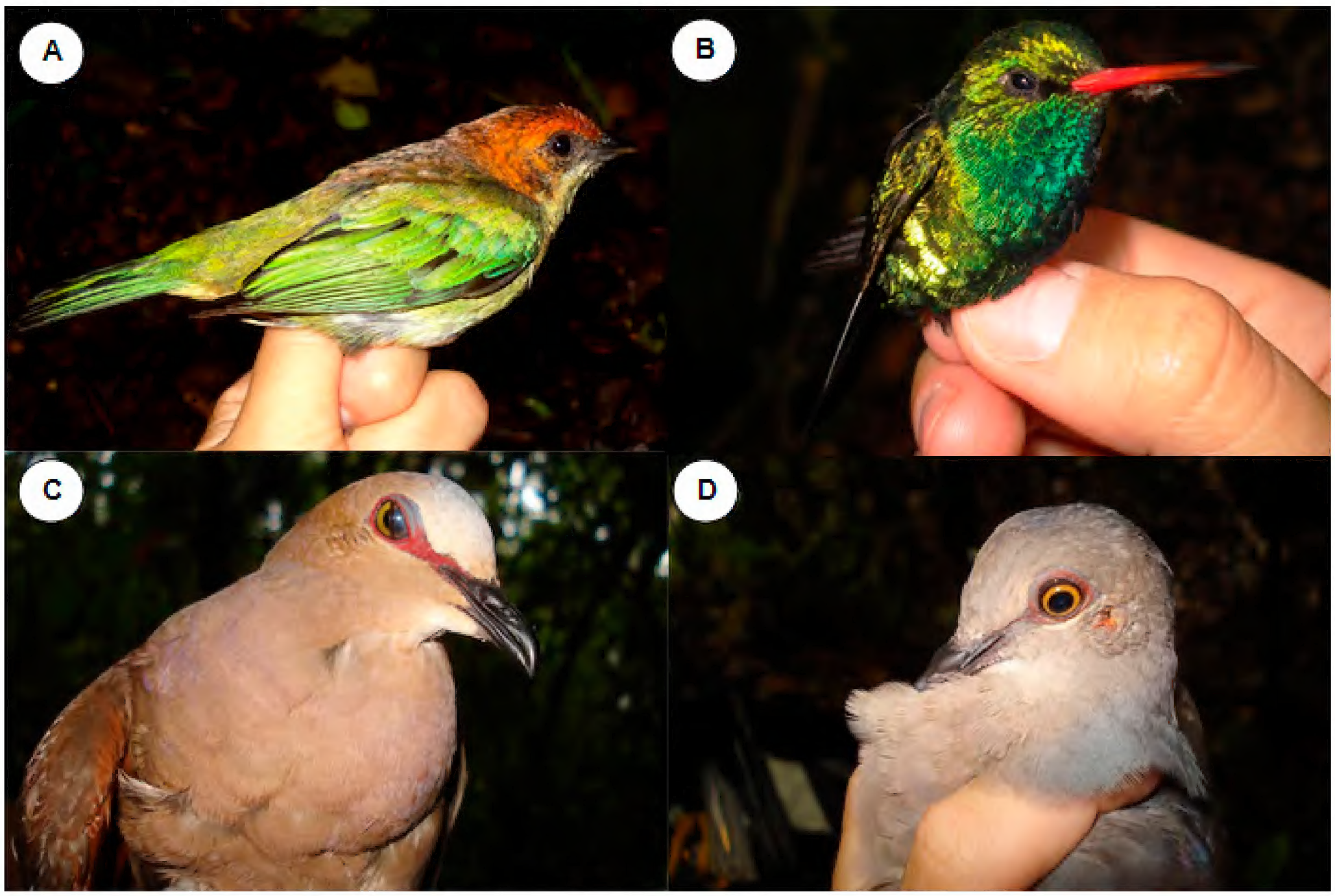

Figure 2. Terrestrial birds ringed at the Arvoredo Island (27°17′30″ S, 048°21′56″ W, 70 m elevation), Arvoredo Marine Biological Reserve, southern Brazil. **A**: Female of *Tangara peruviana* (Desmarest, 1806), vulnerable at global-level and endangered at state-level. **B**: Male of *Chlorostilbon lucidus* (Shaw, 1812). **C**: *Leptotila rufaxilla* (Richard & Bernard, 1792). **D**: *Leptotila verreauxi* Bonaparte, 1855. Photos by Bianca P. Vieira.

Figure 3. Shore and seabirds recorded during surveys at the Arvoredo Marine Biological Reserve, southern Brazil. **A**: *Calidris canutus* (Linnaeus, 1758) resting at São Pedro Rock. **B**: *Thalasseus acuflavidus* (Cabot, 1847) and *Sterna hirundinacea* Lesson, 1831 resting at Deserta Island. **C**: *Stercorarius parasiticus* (Linnaeus, 1758) flying near São Pedro Rock. **D**: *Puffinus puffinus* (Brünnich, 1764) swimming with oil-stain on the chest. Photos by Bianca P. Vieira.

work, their presence could suggest the need of new adaptive management to attend their priorities in the RBMA. However, records from literature must not stand alone and long-term monitoring is important to evaluate the presence of those species and habitat use, as well as the efficiency of the management.

Deserta Island is an important breeding site to *Larus dominicanus*, *Sula leucogaster*, *Sterna hirundinacea*, and *Thalasseus acuflavidus* (Efe *et al.* 2000; Branco 2003a, 2003b; Prellvitz *et al.* 2009; Hogan *et al.* 2010). In this context, Myers *et al.* (1987) point out that breeding efficiency depends on conditions such as abundant food and safety, which is also related to isolation from human disturbances. Only a few places in the state of Santa Catarina support the breeding of migratory species as does the Deserta Island.

Further systematic efforts on terrestrial species are still needed, mainly in Galé and Arvoredo islands. RBMA holds a significant percentage of the marine bird richness of Santa Catarina coastline. The Arvoredo Archipelago is a natural biogeography experiment isolating terrestrial populations from the mainland since the sea-level rose in the quaternary period (Angulo *et al.* 2006). Further studies on terrestrial endemics can provide insights on speciation processes and long-term population viability of isolated areas.

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